

The Species of *Aenasius*, Encyrtid Parasites of Mealybugs ¹

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(Presented by Dr. Carter at the meeting of April 2, 1936)

INTRODUCTION

Among a miscellaneous lot of beneficial insects ³ imported from Brazil into California were three female parasites which are here described under the name *Aenasius paulistus* n. sp. This species became of special interest when S. E. Flanders, of the Citrus Experiment Station, discovered that it was able to reproduce in *Pseudococcus maritimus* (Ehrh.), a mealybug of economic importance in California. The progeny of the three parasites which reproduced in *P. maritimus* were all of the male sex. One of the original females was still alive when the males issued. She was mated with them and allowed to continue ovipositing. No progeny were obtained from this union, and the breeding stock was lost. The following taxonomic study is an outgrowth of the attempt to classify this parasite.

So far as known the species of *Aenasius* are indigenous to the neotropical regions. All the reared species have been obtained from mealybugs of the genera *Pseudococcus*, *Phenacoccus*, and *Puto*. The biology of none of the species is known. Presumably they are primary parasites. The species described in this paper as *Aenasius advena* n. sp. was sent for determination to P. H. Timberlake by O. H. Swezey. This species, reared by Swezey from *Pseudococcus virgatus* Ckll., on the island Oahu, was probably purposely introduced into Hawaii in recent years.* *Aenasius paulistus* n. sp. was obtained by the writer in Brazil, but not from *Pseudococcus maritimus*, the host upon which it was propagated in the quarantine room at the Citrus Experiment Station. In Brazil it was obtained

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³ The collection and shipment of miscellaneous beneficial insects from South America to California was incidental to an exploration for enemies of the red scale, *Chrysomphalus aurantii* (Mask.). This exploration for beneficial insects was made by the University of California Citrus Experiment Station. The salary of the writer was paid by the University of California; the traveling expenses were paid from a fund contributed by various organized citrus growers. Several separate papers are in preparation covering the different phases of the South American exploration.

* From Mexico, 1929. [Ed.]

at São Paulo from an undescribed *Pseudococcus* which in life resembles *P. gahani* Green and in stained preparations presents all the usual diagnostic characters of *P. maritimus*. An attempt is being made to secure living specimens of this parasite from Brazil for further experiments.

In this paper eleven new species are described under the genus *Aenasius* Walker. In the female sex these new species appear generically similar to the genotype except that some of them have tridentate mandibles. Three of the new species are represented by males as well as females. These males differ rather strikingly from

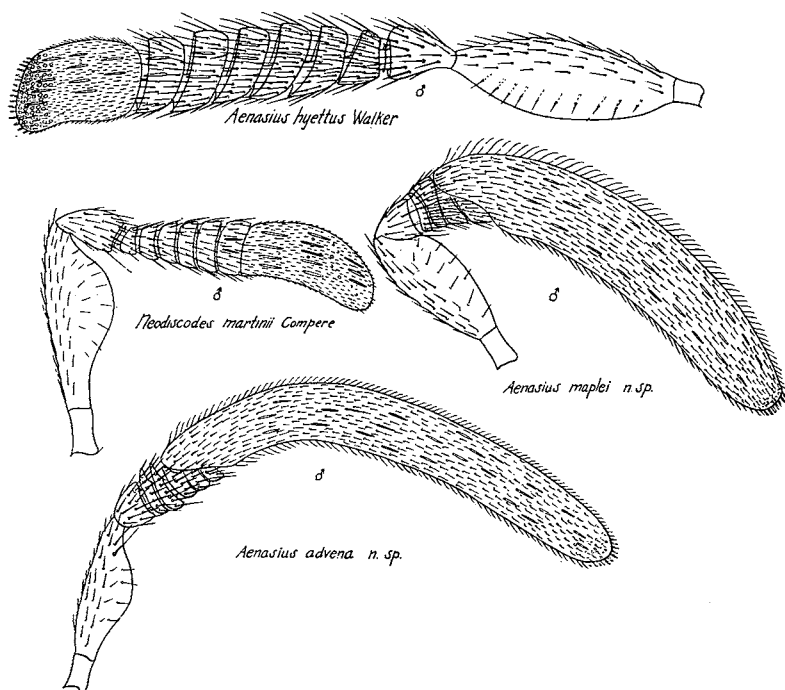


Fig. 1.—Antennae, males, species of *Aenasius* and *Neodiscodes*.

the genotype (fig. 1). In *Aenasius hyettus* Walker, the genotype, the male flagellum is composed of six nearly equal, short, wide, ventrally articulated funicle joints and a short, solid club. In the new species, the male flagellum is composed of from two to five reduced funicle joints and an elongated solid club shaped like a banana, similar to the antennae of male *Chalcaspis* Howard. The

males of the new species are more like male *Chalcaspis* than male *Aenasius*, while the females are more like typical *Aenasius* than *Chalcaspis*. As a matter of fact, *Chalcaspis* Howard and *Neodiscodes* Compere are closely related to *Aenasius* Walker, and the discovery of new species may easily bridge the slight gaps that now exist.

In some respects *Neodiscodes* is intermediate between *Aenasius* and *Chalcaspis*. In the male sex of *Neodiscodes*, the solid club is elongate and about as long as the six-jointed funicle, the basal funicle joints are reduced in size, and those nearest the club appear to be in the process of fusing with the latter. The mandibles are tridentate in *Aenasius caeruleus* Brues, *A. paulistus* n. sp., and in the single species of *Neodiscodes*. In several of the new species represented by one or two tag-mounted specimens a clear view of the apical margin of the mandibles is obscured. The difference in the dentition of the mandibles is not correlated with the different antennal characters of the male sex.

If the species with tridentate mandibles are considered generically distinct from those with bidentate mandibles, it will be necessary to erect a new genus for their reception, since bidentate mandibles characterize both the genotype of *Aenasius* and the species of *Chalcaspis* available for study. In the description of *Chalcaspis pergandei* Howard, the genotype, the dentition of the mandibles is not mentioned. For practical reasons a further subdivision of the group is undesirable. The segregation of the species into different genera on the basis of differences in the dentition of the mandibles and in the male antennae would make it impossible, at this time, to assign the majority of the species to their respective genera. In fact, the relation of these species might be presented more clearly and the classifications simplified by reducing instead of increasing the number of genera.

From Ashmead's description it appears as though *Hemaenasius confusus* is very closely related to the species assembled here under *Aenasius*. In *Hemaenasius confusus*, the anterior portion of the frontovertex is described as smooth and polished and in Ashmead's key to the genera the marginal vein is described as punctiform. The genus *Pentelicus* Howard may be closely related to *Aenasius* and *Chalcaspis*. *Pentelicus* is described as without a marginal vein; it possesses short stigmal and postmarginal veins, and comparatively

long funicle joints. *Chalcaspis brasiliensis* Mercet belongs to this group of species. It is described in the female sex only, as are *Aenasius chapadae* Ashmead and *Aenasius caeruleus* Brues.

The types of the new species are to be deposited in the United States National Museum, except the holotypes of *Aenasius pacificus* and *A. insularis* which are to be deposited in the entomological collection of the California Academy of Science at San Francisco.

KEY TO THE GENERA OF SHORT, STOUT-BODIED ENCYRTIDS WITH THIMBLE-LIKE PUNCTATION ON THE HEAD THAT ARE KNOWN TO BE PARASITIC IN MEALYBUGS¹

1. Head usually with a well defined, rather deep facial impression. Marginal vein plainly longer than wide.....2
- Head without a deep facial impression, gently convex from vertex to oral margin, the scrobes faintly impressed. Marginal vein absent or no longer than wide. Entire frontal aspect of the head with coarse thimble punctation similar to the frontovertex. Male antennae with the funicle reduced to two or three short, transverse segments and the club elongate, solid, shaped like a banana.....**Chalcaspis** Howard
2. Thimble punctures descending between the anterior orbits and the upper part of the facial impression. Face often deeply impressed and semicircular above with steeply or gently sloping sides.....**Aenasius** Walker
- Thimble punctation not descending on the frontal aspect of the head between the inner anterior orbits and the upper part of the facial impression. Facial impression shallow, faint. Frontal aspect of head with fine, close, reticulate punctations. Scape moderately expanded. Mandibles tridentate. Male antennae with six transverse funicle joints and solid elongate club, slightly longer than the funicle.....**Neodiscodes** Compere

Aenasius Walker

Aenasius Walker, Ann. Mag. Nat. Hist., Vol. 17, page 181, 1846. Howard, Jour. Linn. Soc., Vol. 25, page 88, 1894.

Female.—Head menisiform in normal position, the frontovertex vertically inclined; occiput strongly concave, acutely angled at the vertex. Fronto-

⁴ *Zarhopalus Ashmead* is excluded because of its more slender stature, small scutellum, and faint punctuation. Although frequently compared with *Chalcaspis* because of coarse thimble punctuation on the head, neither *Discodes* Förster nor *Bothriothorax* Ratzburg belong to this group. *Bothriothorax* is parasitic in dipterous puparia and *Discodes* in comparatively hard coccids. In these two genera the ovipositors are rigid, not enclosed by the ventrites to the apex of the abdomen, and are adapted for the drilling of tough, leathery derm. The forms included here have flexible, thrusting ovipositors for penetrating soft-bodied insects; when in repose these organs are enclosed by the ventrites to the apex of the abdomen. *Eugahania* Mercet, a form parasitic in coccids, may possibly belong in this key, but no specimens of *Eugahania* are available for study and no mention is made of the type of ovipositor in the descriptions.

vertex from one-fifth to one-third width of head, with coarse, impressed, umbilicate punctation which usually descend between the anterior inner orbits and upper portion of the facial impression. Posterior ocelli nearly contiguous with the orbits. Eyes strongly pubescent, large, mostly lateral, reaching downward two-thirds the depth of head. Cheeks short with distinct sulci. Face well impressed, semicircular above and often with steep sides; the area between the sockets plane or slightly raised. Antennae eleven-jointed exclusive of the ring joint, the latter often appearing more like a very short first funicle joint instead of a ring joint. Scape variable, usually widely expanded and compressed below. Pedicel generally approximately one and one-half to two times as long as wide and about as long as the following three funicle joints. Club three-segmented, large, and often obliquely truncate at the apex. Maxillary palpi four-jointed; labial palpi three-jointed. Mandibles either bidentate or tridentate, the teeth rather small, unequal.

Thorax slightly convex above; in some species the scutellum almost plane with vertical sides. Pronotum short, often concealed by the head. Mesoscutum generally plainly shorter than the scutellum, the latter generally large, rounded at apex and often with a short, median, impressed, longitudinal line at the base. Axillae separated; sutures separating the axillae from the scutellum often faint and indistinct. Abdomen short, conic ovate; ovipositor not exerted, when in repose enclosed to apex of abdomen by the ventrites. Femora of forelegs widened and compressed beneath. Legs usually short and inclined to be thick.

Forewings more or less embrowned and coarsely ciliated on the basal portions; often triangular in shape; marginal fringe short; costal cell wide; marginal and postmarginal veins sometimes very narrowly separated from the costal margin; a short, narrow flap at base of blade near the posterior margin folds flat against the blade when wings are in repose and stands at a right angle to the blade when the wings are outspread; marginal vein generally at least twice as long as wide and shorter than the postmarginal vein; postmarginal vein sometimes slightly curved; stigmal vein often not enlarged at apex, about as long as the marginal vein. Hind wings with a wide costal cell; downward projection of the venation often with a short, spur-like, basal vein projecting towards the base.

Mesoscutum, axillae, and scutellum with short, soft setae. Umbilicate punctations on head, each with a more or less flattened refractive seta arising in the center. Coloration dominantly dark metallic; head and parts of the thorax bluish, greenish, or violaceous but usually a blend of these colors.

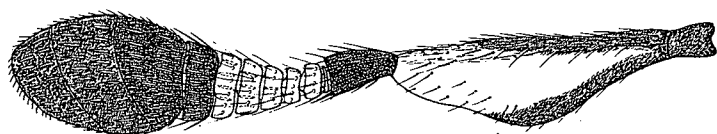
Length ranging from 1.2 to 2.0 mm.

Male.—The males are smaller in size, more uniformly black with less metallic coloration; wings hyaline or nearly so and finely ciliated; thorax convex; head and antennae different from those in the female sex. The males of only four species are known. The principal difference between the males and females is the shape of the head and the antennal charac-

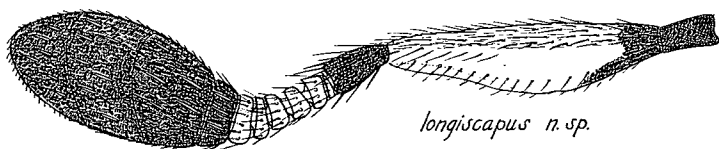
ters. Frontovortex shorter and more horizontal than in the females; eyes reaching downward about one-half the depth of head; cheeks almost as long as the transverse diameter of the eyes. Face slightly impressed, vertical with head in normal position. Antennae varying as shown in figure 1.

KEY TO THE SPECIES OF AENASIUS FEMALES

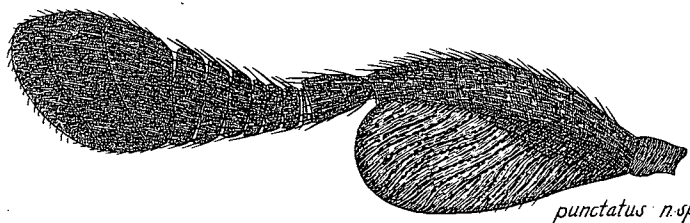
1. Scape with a wide expansion below.....2
 Scape slightly or moderately expanded below, at least two and one-half times as long as wide.....9
2. Antennae completely blackish except the oblique apex of the club which may be brown.....5
 Antennae partly testaceous.....3
3. Frons not meeting the facial impression at a sharp angle, the sides of facial impression not steep and almost smooth; anterior corners of the eyes not margined by coarse punctations all the way to the genal sulci4
 Frons almost ledge-like; sharply angled at meeting the facial impression; sides of facial impression almost smooth, steep, and bright blue-green. Two rows of coarse punctations between the orbits and facial impression stop far short of the genal sulci. Scape almost as wide as long and much wider than the club. Forewings slightly inflexed on the posterior margin beyond the thickened edge; a small, hairless, hyaline area just beyond the apex of the postmarginal vein. First five funicle joints testaceous. Panama.....1. *frontalis* n.sp.
4. Head dominantly bright green, brassy in proximity to the anterior ocellus; collar of pronotum and mesoscutum faintly greenish in contrast to the faintly bluish-black axillae and scutellum. Legs almost completely blackish except the first four tarsal joints of all legs and knees of middle legs. Mexico, Hawaii.....2. *advena* n.sp.
 Head dominantly violaceous, green in proximity to the anterior ocellus and in the facial impression; mesoscutum bluish-black with violaceous reflections, collar of pronotum brighter blue in contrast and the scutellum and axillae darker in contrast. Middle legs almost completely brown. Panama.....3. *ianthinus* n.sp.
5. Mesoscutum without thimble-like punctation comparable to that of the head6
 Mesoscutum with thimble-like punctation similar to that on the head only less distinctly impressed. Head blue, thorax above blue black, beneath aeneous black. Scutellum about twice as long as the mesoscutum. Brazil.....4. *chapadae* Ashmead
6. Sides of thorax and the abdomen at base on sides not granular in appearance7
 Sides of pronotum, prepectus, mesopleura, metapleura, propodeum, and sides of abdomen at base nearly uniformly granular in appearance, this effect produced by fine reticulate punctations. Head and parts of the thorax on sides bright blue. Brazil.....5. *punctatus* n.sp.



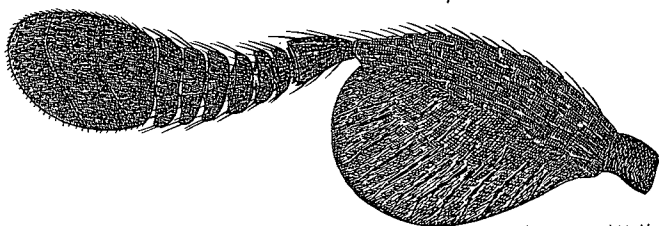
cariocus n. sp.



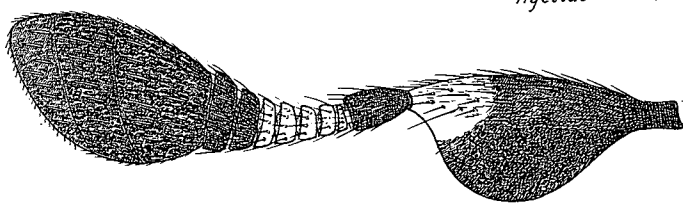
longiscapus n. sp.



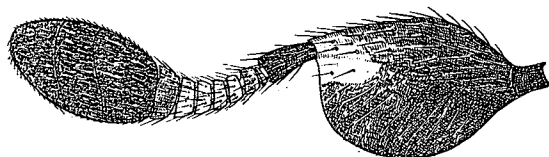
punctatus n. sp.



hyettus Walker



advena n. sp.



frontalis n. sp.

Fig. 2.—Antennae, females, species of *Aenasius*.

7. Mesoscutum and scutellum not bright metallic blue.....8
 Head, mesoscutum and scutellum bright, metallic blue; abdomen
 bluish with a purple cast. The narrowest part of the frontovertex
 less than one-fifth the width of head. Facial impression nearly
 smooth. Scutellum about one and one-fourth times as long as the
 mesoscutum. Mandibles tridentate. Mexico.....6. *caeruleus* Brues
8. Ocelli in an acute angle; frontovertex at the narrowest part about
 one-fifth as wide as the head. West Indies, Panama.....
7. *hyettus* (Walker)
 Ocelli in a right angle; frontovertex at the narrowest part slightly
 more than one-fourth as wide as the head. California.....8. *maplei* n.sp.
9. Scutellum with fine tessellate reticulations and setiferous punctation
 no coarser than those on the mesoscutum. Tegulae brownish or
 black; femora and tibiae usually more or less brown.....10
 Scutellum with coarse punctations. Tegulae blue. Femora and tibiae
 blackish. Brazil.....9. *brasiliensis* (Mercet)
10. Umbilicate punctations in two or three irregular rows between the
 inner anterior orbits and facial impression and descending well
 below an imaginary line tangent to the upper margin of the facial
 impression. Forewings with a small, hairless, hyaline break distad
 of the apex of the stigmal and postmarginal veins. Postmarginal
 vein not extending as far distad as the stigmal vein and with a
 long seta at apex.....11
 Umbilicate punctations between the inner anterior orbits and facial
 impression not descending much below the upper margin of the
 facial impression. Facial impression shallow, widely semicircular
 above almost reaching the orbits, the sides slightly declivous. Fore-
 wings without a small, hairless, hyaline break distad of the apex
 of the postmarginal and stigmal veins. Postmarginal vein extending
 distad slightly further than the stigmal vein and without a single
 long seta at apex.....13
11. Ocelli in a right triangle. Frontovertex at narrowest with five rows
 of irregularly placed coarse, umbilicate punctations; two rows of
 coarse, umbilicate punctations between the inner anterior orbits and
 facial impression12
 Ocelli in an obtuse triangle. Frontovertex at narrowest with seven or
 eight rows of irregularly placed coarse, umbilicate punctations;
 three rows of coarse, umbilicate punctations between the inner
 anterior orbits and facial impression. Antennal club twice as long
 as wide and longer than the pedicel and funicle joints combined.
 Brazil.....10. *longiscapus* n.sp.
12. Forewings triangular, not reflexed on the outer anal curvature; the
 integumentary infuscation not extending distad beyond the specu-
 lum. Sixth funicle joint and club black. Femora and tibiae of
 middle and hind legs rather extensively marked with blackish; spur
 of middle tibiae and apical tarsal joints fuscous. Brazil.....
11. *cariocus* n.sp.

Forewings less distinctly triangular, the posterior margin slightly reflexed on the outer anal curvature; integumentary infuscation gradually fading towards the apex of the blade. Sixth funicle joint and most of the club testaceous. Femora, tibiae, tibial spurs, and all tarsi of the middle and hind legs mostly brown. Tres Marias.....
12. *pacificus* n.sp.

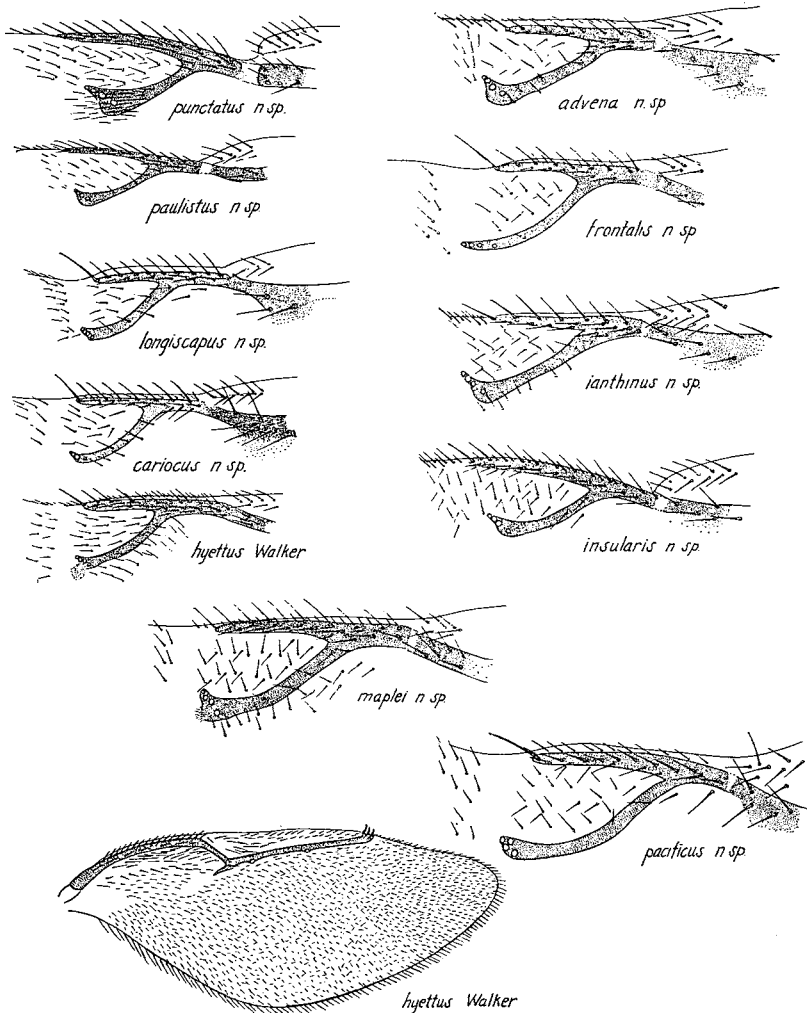


Fig. 3.—Venation, females, species of *Aenasius*, and hind wing of *Aenasius hyettus* (Walker).

13. Antennal club largely testaceous, blackish towards the base. Femora and tibiae of middle legs, tibial spurs, and all tarsi mostly brown. Forewings with the embrowned pattern curving outward from the apex of the stigmal vein to the change of angulation on the posterior margin. Tres Marias.....13. *insularis* n.sp.
 Antennal club completely black. Femora and tibiae of middle legs usually dominantly blackish; tibial spur of middle legs and apical tarsal joints blackish. Forewings with the embrowned pattern fading out near the apical margin. Brazil.....14. *paulistus* n.sp.

1. ***Aenasius frontalis*** n. sp. (Figures 2-3).

The most distinctive characters of this species are the slightly ledge-like anterior margin of the frons which is carinated at meeting the facial impression; a slight inflexion of the forewings on the posterior margin, just beyond distal end of the thickened edge which guides the hooklets; hairless, hyaline break on the costal margin of the blade just beyond apex of the postmarginal and stigmal veins; ocelli in an equilateral triangle.

Female.—Head bright blue-green to violaceous; facial impression dominantly green, highly refringent, and almost polished, black and more opaque in proximity to the mouth. Thorax and abdomen metallic black to brownish; pronotum faintly bluish. Apex of scape and first four or more funicle joints testaceous. the remainder of the antennae blackish with slight metallic reflections on the scape. All coxae blackish, remainder of the legs light brown. Forewings strongly embrowned on the basal half, fading towards the apex.

Scape widely expanded below, about one and one-half times as long as wide (9:7) and much wider than the club (7:4). Sides of face steeply declivous, finely transversely aciculated, smoother than in the other species. Two rows of coarse punctations descending between the inner anterior orbits and upper part of the facial depression but not extending to the sulci. Marginal and postmarginal veins very narrowly separated from the costal margin; stigmal vein narrowed at the apex and as long as the marginal and postmarginal veins. Postmarginal vein with a large seta at apex. Anterior margin of forewings with a short, transverse, hairless, hyaline break just beyond apexes of postmarginal and stigmal veins. Marginal fringe on the distal anal curvature composed of short, curved cilia.

Axillae separated by a distance almost equal to their greatest length. Median longitudinal line at base of scutellum reduced to a faint, short impression hardly perceptible. Length, 1.8 mm.

Described from 3 females, holotype and paratypes, collected by D. T. Fullaway at Ancon, Taboga, and Montelirio, Panama, March and July, 1924.

2. *Aenasius advena* n. sp. (Figures 1, 2, 3.)

In this species three rows of coarse punctations descend between the inner anterior orbits and upper part of the facial depression and extend almost to the genal sulci; mesopleura finely reticulate punctate, appearing granular under low magnification; ocelli in an equilateral triangle.

Female.—Head bright, metallic green, distinctly bronzy in proximity to the anterior ocellus. Pronotum violaceous to bluish black and much brighter than the mesoscutum, axillae, and scutellum. Abdomen dark metallic. Sides of thorax aeneous. Tarsi, except the apical joints, testaceous, remainder of the legs blackish. Apex of scape and first four funicle joints testaceous. Forewings deeply embrowned on basal half becoming hyaline near the apex.

Scape almost twice as long as wide, as wide as the club. Submarginal and marginal veins separated by a distinct hyaline break. Stigmal vein slightly swollen at apex, about as long as the marginal and postmarginal veins united. Postmarginal vein without a large seta at apex and the marginal fringe on the costa continuous from the apex of postmarginal vein. Mandibles bidentate. Axillae closely fused with the scutellum, the sutures hardly discernible. Length, 2 mm.

Male.—Face and cheeks with greenish-blue reflections, remainder of head and body black; tarsi dirty white to brownish; the apical joints dusky. Wings hyaline. Frontovortex fully one-third as wide as the head; ocelli in a strongly obtuse triangle; umbilicate punctations small and numerous, about seven or eight irregularly placed across narrowest part. Antennae shown in figure 1.

Described from 12 females and 8 males, holotype, allotype, and paratypes, collected and reared by O. H. Swezey from *Pseudococcus virgatus* Ckll., Koko Head and flats west of Makapuu Head, Oahu, Territory of Hawaii, February and March, 1934.

3. *Aenasius ianthinus* n. sp. (Figure 3).

This form, represented by a single female, may prove to be a variant of the foregoing species. Structurally it does not appear much unlike *A. advena* n. sp., but the coloration of the head is conspicuously different.

Female.—Frontal aspect of the head dominantly bright purple; mixed bluish green and purple reflections in the facial impression except bordering the mouth which is black. Frontovortex bluish green near the anterior ocellus. Pronotum bluish green blended with violaceous. Mesoscutum, axillae, and scutellum black with violaceous reflections predominant. Femora and tibiae of middle legs light brown to fuscous.

The punctations on the anterior frons are coarse and close together appearing more as if formed by raised lines than by thimble impressions, in this character differing from the other species.

Described from 1 female, holotype, reared by D. T. Fullaway from *Pseudococcus virgatus* Ckll., at Panama, July, 1924.

4. *Aenasius chapadae* Ashmead.

Aenasius chapadae Ashmead, Proc. U. S. Nat. Mus., Vol. 22, page 371, 1900.

Habitat: Chapada, Brazil.

5. *Aenasius punctatus* n. sp. (Figures 2, 3).

The comparatively coarse reticulate punctations on the sides of the thorax combined with bright coloration readily distinguish this species.

Female.—Head, pronotum, prepectus, anterior dorsal margin of the mesopleura, and dorsum on sides of the propodeum dominantly metallic blue. Mesoscutum, axillae, and scutellum with blended bluish and violaceous reflections. Tegulae brown to blackish. Abdomen dark violaceous except the reticulate punctate areas on sides near the base where bluish predominates. Mesopleura posteriorly and ventrally violaceous. Facial impression greenish. Antennae black. Legs dark brown to blackish; tarsi of middle and hind legs, except the apical joints, brown. Forewings embrowned from the base to near the apex, the embrowned pattern about like that of *A. paulistus* as shown in figure 4.

Head, vertical position, dorsal aspect, about five times as wide as long (3:16); frontovertex one-fourth the head width; ocelli in a right angle, the posterior pair touching the orbits and one-half their diameter from the occiput; four irregular rows of umbilicate punctations on the narrow part of the frontovertex. Head, vertical position, frontal aspect, about as wide as high. The umbilicate punctations which descend in two rows along the inner orbits stop short of the genal sulci; cheeks finely reticulate punctate except towards the sides where the reticulations become shortly striate; the median space between the antenna sockets sculptured similar to the cheeks; the scrobes less coarsely sculptured and greenish in contrast to the bluish cheeks.

Scape widely expanded, less than twice as long as wide (21:12); the ventral expansion gradually increasing in width towards the apex. Pedicel slightly longer than wide. Funicle joints transverse, all gradually increasing in size, all about three times as wide as long, the sixth twice as wide as the first. Club about one and one-half times as long as wide, about as wide as the length of the six funicle joints combined. Length, 1.4 mm.

Described from 3 females, holotype and paratypes. Two of the

specimens were reared from *Phenacoccus* sp. collected by H. Compere on *Tibouchina granulosa*, Orchidarium, São Paulo, Brazil, November 5, 1934, and the other specimen captured near this host and on the same plant.

6. *Aenasius caeruleus* Brues.

Aenasius caeruleus Brues, Bul. Amer. Mus. Nat. Hist., Vol. 28, page 84, 1910.

Habitat: Vera Cruz, Mexico.

7. *Aenasius hyettus* (Walker) (Figures 1, 2, 3).

Encyrtus hyettus Walker, Ann. Mag. Nat. Hist., Vol. 17, page 181, 1846.

Aenasius hyettus Howard, Jour. Linn. Soc. Zool., Vol. 25, page 89, 1894. Jour. Linn. Soc. Zool., Vol. 26, page 146, 1896.

In 1846, Francis Walker described a species from St. Vincent's Island, British West Indies, as *Encyrtus hyettus*, and in a separate paragraph stated: "This species may be considered as the type of a new genus, for which I propose the name *Aenasius*." In his report on the parasitic Hymenoptera of the Island of St. Vincent in 1894, Dr. L. O. Howard recognized and described a species as *Aenasius hyettus* (Walker). Howard stated that he had little or no doubt concerning the accuracy of his identification. In 1896 Howard identified some specimens from the Island of Grenada as *A. hyettus*. In the collection of P. H. Timberlake is a series of 17 females and 34 males from Panama which appear to be specifically similar to a female and male of the Grenada samples determined by Howard in 1896 as *A. hyettus* Walker. The specimens from Panama, as well as the Grenada samples, are not in entire agreement with either the original description by Walker nor the redescription by Howard, especially in regard to the wing venation. In the original description Walker stated: "... humerus (submarginal) much less than half the length of the wing; ulna (marginal) about one-third of the length of the humerus (submarginal); radius (postmarginal) short; cubitus (stigmatal) long, not much shorter than the ulna (marginal); stigma very small." Howard described the venation as follows: "... submarginal vein short; marginal vein very

short, almost wanting; stigmal vein rather long, slender, very slightly curved. . . ."

Walker's and Howard's descriptions relative to wing venation are not in agreement, nor does either of these descriptions fit the specimens identified as *Aenasius hyettus* (Walker) in this paper. Except for this discrepancy, the available evidence indicates that Howard recognized Walker's species correctly, and that the species from Panama is similar to the Grenada and St. Vincent species.

The males were first described by Howard in 1894. It has already been pointed out that in the male sex *Aenasius hyettus* (Walker) differs rather strikingly from the other species which are represented by male specimens. Although some encyrtid genera have been erected on the basis of male characters which differ less than those separating *A. hyettus* from some of the species assembled here, no practical purpose will be served by subdividing the group on the basis of male characters when the females do not present comparable differentiating characters.

Female.—Metallic coloration variable. Generally the frontovertex bluish green, often with an admixture of violaceous and faintly greenish in some specimens. Facial impression usually more brilliantly green than the frontovertex and often partly blue or violaceous. Apparently any blend of these colors may appear. Pronotum slightly more bluish than the mesoscutum. Mesoscutum, axillae, and scutellum black with faint bluish, greenish, or violaceous reflections or almost non-metallic. Sides and under parts of thorax and abdomen black. Antennae black. Legs black to brown, the brown on the distal part of the posterior femora, middle femora, and tibiae and tarsi except the apical joints. Spur of middle tibiae fuscous. Forewings strongly embrowned.

Frontovertex slightly narrower than in most species, at the narrowest part a trifle less than one-fourth the greatest head width; orbits diverging anteriorly and posteriorly from the anterior ocellus; ocelli in an acute triangle. Four irregular rows of large, shallow, umbilicate punctations across the narrow part of the frontovertex; two rows of coarse, umbilicate punctations descending between the anterior orbits and facial impression; the coarse punctations fade out at the abrupt change of angulation between the frontal and lateral planes of the head. Facial impression deep with steep sides, almost carinated at junction with the frons. Mesopleura almost smooth anteriorly. Lateral margins of scutellum faintly reflexed, the so-called "rim" of Walker's and Howard's descriptions, a character common to most species. Scutellum tessellate, reticulate, at base with a short, median, longitudinal depressed line. Axillae narrowly separated; axillar-scutellar sutures faint. Mandibles bidentate.

Antennal scape one and one-half times as long as wide. Club relatively small, slightly longer than wide and one-half as wide as the scape.

Forewings deeply embrowned at the base, gradually fading towards the apex. Marginal vein about one-sixth the length of the submarginal vein and slightly shorter than the postmarginal vein; postmarginal vein extending as far distad as the stigmal vein; stigmal vein slightly and gradually widening towards the apex, marginal and postmarginal veins narrowly separated from the costa. Costa beyond the distal end of postmarginal vein with marginal cilia; a small, hairless, hyaline area distad of the termination of the postmarginal and stigmal veins. Hind wings with a distinct, short, spur-like basal vein projecting inward from the downward bend at the junction of the submarginella and marginella (fig. 3). Length, 1.5 mm. to 2.0 mm.

Male.—Darker in color than the female. Dorsum of thorax faintly metallic; frontovertex violaceous; face dominantly dark greenish blue. Legs mostly black with a faint admixture of brownish on the middle tibiae and to a less extent on middle femora and at apex of hind femora; tarsi brown to fuscous; testaceous on the basal part of the basitarsus of the middle and hind legs. Forewings hyaline.

Frontovertex twice as long as wide and less than one-third as wide as the head; ocelli in an acute triangle. From four to five rows of irregular, coarse, umbilicate punctations across the frontovertex anterior to the median ocellus. Antennae as shown in figure 1.

Postmarginal vein much longer than the marginal vein and reaching distad much further than the stigmal vein. Length, 1.2 mm. to 2.0 mm.

Redescribed from 17 females, 34 males collected by D. T. Fullaway at various localities in Panama, 1924, and from 1 female and 1 male collected by H. H. Smith, Balthazar, Windward side, Grenada, W. I. The Grenada specimens determined by L. O. Howard as *A. hyettus* (Walker).

8. *Aenasius maplei* n. sp. (Figures 1, 3).

Female.—Dominantly black; frontovertex, temples, cheeks, and pronotum mostly greenish blue; the punctations on the frontovertex, between the median ocellus and facial impression, highly polished and with brassy reflections. Mesoscutum, axillae, and scutellum shining, almost non-metallic. Basitarsus of middle and hind legs dirty white, the remainder of tarsi brown to fuscous. Antennae completely black. Forewings deeply embrowned, pale towards the apex.

Frontovertex at narrowest part almost one-third the head width; ocelli in a right angle; three more or less distinct rows of coarse, umbilicate punctations descend between the anterior orbits and the facial impression. Facial impression deep with steep sides. Mesoscutum, axillae, and scutellum finely punctate reticulate. Scutellum almost plane, at the

base a short, longitudinal, median, impressed line. Axillar-scutellar sutures faint.

Scape about as shown in the figure of *A. hyettus*: one and one-half times as long as wide; club less than one and one-half times as long as wide, and narrower than the scape (10:13).

Marginal vein rather short, not much more than twice as long as wide, plainly shorter than the postmarginal vein; postmarginal vein not reaching as far distad as the stigmal vein; a hyaline, hairless break just beyond the apex of postmarginal and stigmal veins. Length, 1.8 mm.

Male.—Black, only the proximal part of the basitarsus of the middle and hind legs dirty white. Frontovortex granularly punctate reticulate without coarse, umbilicate punctures. Facial impression not contiguous with the orbits above. Length, 1.4 mm.

Described from 2 females and 4 males, holotype, allotype and paratypes, reared from *Puto yuccae* Coq. collected at Santa Paula, California, by John D. Maple, April 30, 1935.

9. *Aenasius brasiliensis* (Mercet).

Chalcaspis brasiliensis Mercet. Eos, Rev. Espan. Entom. Vol. 2, No. 1, page 46, 1926.

This species described from Brazil appears from the description to be closely related to *A. paulistus* n. sp. in many respects. According to the description and figure given by Mercet, the mesoscutum has sparse setiferous punctures, and in contrast the scutellum is coarsely punctated. In all the species at hand the scutellum is not any more coarsely punctate than is the mesoscutum. The light brown apical half of the club and blue tegulae will also aid in the identification of this species.

Habitat: Corumba, Brazil.

10. *Aenasius longiscapus* n. sp. (Figures 2, 3).

Female.—Frontovortex metallic blue green to violaceous, blackish in proximity to the ocelli. Thorax and abdomen shining black, faintly violaceous in parts; the pronotum slightly bluish. Scape testaceous except narrowly at base which is black; pedicel black; first five funicle joints testaceous; sixth funicle joint and club black. Legs blackish to brown, the basitarsus of middle legs almost colorless; apex of middle and hind femora brown, corresponding tibiae brown blended with fuscous; tarsi light brown, the apical joints fuscous. Forewings deeply infuscated on the basal part, paler towards the apex.

Frontovortex at narrowest part about one-third the head width with

approximately eight irregular rows of coarse, umbilicate punctations; three rows of umbilicate punctations descend between the anterior orbits and facial impression; ocelli in a slightly obtuse triangle. Mesoscutum about one-half as long as the scutellum and hardly longer than the width of the frontovertex. Submarginal vein with the ventral margin towards the apex expanded and merging into the deep infuscation of the blade; postmarginal vein a trifle shorter than the stigmal vein, the latter with a long seta at apex; a short, narrow, hyaline, hairless break at apex of postmarginal and stigmal veins. Antennal scape more than four times as long as wide (22:5), the greatest width proximad of the center; club large, twice as long as wide, longer than the pedicel and funicle united, and slightly shorter than the scape. Length, 1.4 mm.

Described from 1 female, holotype, captured by H. Compere at Campinas, Brazil, November 26, 1934.

11. *Aenasius cariocus* n. sp. (Figures 2, 3).

Female.—Frontovertex bright purplish blue, ocellar area violaceous black; facial impression brassy green, blackish above the mouth and between the sockets; thorax and abdomen black, faintly violaceous. Distal ends of front tibiae, most of middle femora and tibiae, hind femora at distal ends, and most of hind tibiae and all tarsi light brown; tibial spur of middle legs blackish. Basal part of forewings infuscated as far distad as the outer margin of the speculum. Dorsal and ventral margins of the scape on basal two-thirds blackish; pedicel, sixth funicle joint, and club black.

Frontovertex at narrowest almost one-third the head width (6:21); five irregular rows of coarse, umbilicate punctations on narrow part of frontovertex and two rows of coarse punctations, in addition to the orbital rows of smaller punctations, descending between the anterior orbits and facial impression; ocelli in a right angle. Scutellum one and one-half times as long as the mesoscutum. Wing venation about like that of *longiscapus* n.sp. Antennal scape widest at the middle, less than four times as long as wide (21:6); club about one and one-half times as long as wide and about as long as the six funicle joints. Length, 1.4 mm.

Described from 1 female, holotype, captured by H. Compere at Campinas, Brazil, November 26, 1934.

12. *Aenasius pacificus* n. sp. (Figure 3).

Female.—Frontovertex mostly black metallic blending to bluish green anteriorly; facial impression and cheeks mostly metallic bluish green; blackish near the mouth. Ventral margin of scape narrowly on the basal third and pedicel dark brown or blackish. Club testaceous on the inner face, the outer face more or less brownish. Thorax and abdomen mostly

black metallic, the sides and underparts of the former tending to dark brown. Tarsi and most of tibiae brown, the latter more or less suffused with fuscous on the outer aspect of the basal half or so; femora mostly fuscous, brownish towards the apical ends. Forewings embrowned, dark towards the base and fading towards the apex.

Frontoververtex, at narrowest part, almost one-third as wide as the head (11:37); ocelli in a right triangle, the median ocellus twice its own diameter from the orbits; four irregular rows of large, shallow, umbilicate punctations anterior to the median ocellus; the setae which arise from the center of each umbilicate punctation about as long as the diameter of the punctation. Two rows of coarse punctations descending between the anterior orbits and facial impression. Mesoscutum hardly longer than the width of the frontoververtex. Axillae slightly separated, the axillar-scutellar sutures hardly perceptible; scutellum with a short, median, longitudinal impressed line at base. Marginal vein hardly twice as long as wide; postmarginal vein twice as long as the marginal vein; stigmal vein extending distad further than the postmarginal vein; a hyaline, hairless break just beyond the ends of the postmarginal and stigmal veins. Antennal scape slightly expanded, almost four times as long as wide (15:4), widest at the middle; pedicel about twice as long as wide; first three funicle joints almost subequal, the last three very appreciably increasing in width. Club large, about twice as wide as long, plainly wider than the scape and as long as the pedicel and funicle joints united. Length, 1.6 mm.

Described from three females, holotype and paratypes, collected by H. H. Keifer at Magdalena and Maria Madre islands, Tres Marias, May 17, 19, 1925.

13. *Aenasius insularis* n. sp. (Figure 3).

Female.—Upper part of facial impression bright bluish green, the frontoververtex somewhat darker, partly violaceous, and the punctations partly brassy. Mesoscutum, axillae, and scutellum bluish black. Scape blackish at the base and on the ventral expansion for two-thirds the length, the apex and dorsal thickened part except at base testaceous; pedicel blackish; funicle joints testaceous; base of club blackish, the apical two-thirds or so testaceous. Legs mostly light brown or testaceous with blends of dark brown to fuscous. Forewings lightly embrowned basally, broadly hyaline towards the apex; the embrowned cloud curving outward and downward from the stigma to the apex of the thickened edge on the posterior margin.

Frontoververtex at narrowest part slightly more than one-fourth the head width (11:41); ocelli in a right triangle; the median ocellus about one and one-half times its own diameter from the orbits. Facial impression shallow with slightly sloping sides, broadly semicircular above and narrowly separated from the orbits. Face without coarse, umbilicate punc-

tations between the orbits and the impression, the coarse punctations fading out just below an imaginary line drawn tangent to the upper margin of the facial impression. Axillae only slightly separated at inner tips. Scutellum with a distinct, short, median, longitudinal line at base. Postmarginal vein almost twice as long as the marginal vein and reaching further distad than the stigmal vein; costal margin of forewings abruptly reflexed at apex of costal cell; without a hyaline, hairless break beyond the apex of postmarginal and stigmal veins. Antennal scape moderately expanded about three times as long as wide; pedicel one and one-half times as long as wide; ring joint almost one-half the size of the first funicle joints; funicle joints all increasing in width, the sixth about four times as wide as long; club large, twice as long as wide, longer than the pedicel and funicle joints united and a trifle wider than the scape. Length, 1.6 mm.

Described from four females, holotype and paratypes, collected by H. H. Keifer at Magdalena and Maria Madre islands, Las Tres Marias, Mexico, May 17, 19, and 20, 1925.

14. *Aenasius paulistus* n. sp. (Figures 3, 4).

In some respects this species appears suspiciously like the one described by Ashmead in 1900 from Brazil. However, even when allowance is made for the possibility that Ashmead used a hand lens instead of a microscope when preparing his description, there remain reasons to consider this form as different. In this species the mesoscutum and scutellum are tessellate reticulate with faint setigerous punctures, and under no magnification does the mesoscutum appear to have thimblelike punctations similar to those on the head. Also, the scutellum in this species is only slightly longer than the mesoscutum. Ashmead described *A. chapadae* as having the thorax similar to *A. hyettus* (Walker) except that the mesonotum has the thimblelike punctation similar to that of the head but less distinctly impressed; the scutellum is twice as long as the mesoscutum with the punctation almost obsolete.

Female.—Frontovertex metallic blue-green; facial impression dominantly greenish; thorax above faintly bluish black, the pronotum more refringent and bluish; sides and under parts of thorax and the abdomen shining black. Scape on basal half and on ventral margin to apex, pedicel and most of club blackish; apical portion of scape, funicle, and apex of club testaceous. Legs black to brown; femora and tibiae of middle and hind legs, especially towards the distal ends, diluted with brown; all tarsi brownish. Forewings embrowned as shown in figure 1.

Frontovortex at narrowest less than one-third the head width (8:28); four to five irregular rows of coarse, umbilicate punctations anterior to the median ocellus; ocelli in a right triangle; between the anterior inner orbits and facial impression the coarse punctations fade out just below an imaginary line tangent to the upper part of the facial impression. Facial impression shallow with wide, gently sloping sides, widely semi-circular above and closely approaching the orbits. Scape almost two and one-half times as long as wide, moderately expanded; pedicel one and one-half times as long as wide; ring joint large and furnished with setae, asymmetrical, except for smaller size not unlike a funicle joint; the six funicle joints successively increasing in width so that the sixth is four or five times as wide as long; club almost twice as long as wide and as long as the pedicel and funicle together. Mandibles tridentate, a small, upper, inner tooth easily overlooked. Scutellum slightly longer than the mesoscutum. Axillae slightly separated. Length, 1.2 mm.

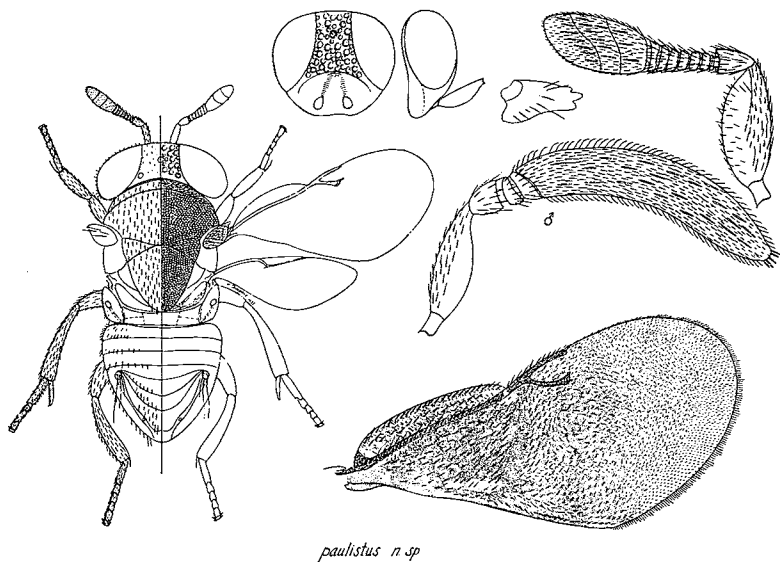


Fig. 4.—*Aenasius paulistus* n. sp., female, body, head, mandible, antenna, and wing; male, antenna.

Male.—Entirely black except most of the tarsi, apex of middle tibiae, and slightly at apex of middle femora which are brown; apical tarsal joints dusky.

Antennae composed of five joints; scape, pedicel, two short transverse funicle joints, and a greatly elongated, thick, compressed, densely setose club. Frontovortex with smaller, shallower, and more numerous punctures than in the female. Head slightly lenticular; frontovortex longer than wide (4:3); ocelli in a right triangle, the posterior pair almost touching

the orbits and narrowly separated from the occipital margin. Forewings without an embrowned pattern. Length, 1.2 mm.

Described from 2 females and 4 males, holotype, allotype, and paratypes, propagated on *Pseudococcus maritimus* (Ehrh.) by S. E. Flanders in the quarantine room of the insectary of the Citrus Experiment Station at Riverside. The males are the progeny of the females. Flanders reared three females from a *Pseudococcus* sp., obtained in a shipment from Brazil, which he determined as *P. maritimus* (Ehrh.). Although this *Pseudococcus* has the usual diagnostic characters of *P. maritimus*, it is not that species but one which looks almost exactly like *P. gahani* in life. It is being described as a new species by Edson Hambleton. This mealybug was found lightly infesting *Hedera helix* at Avenida Paulista, São Paulo, Brazil. In addition to the series of type specimens which are definitely correlated with the host, two females and two males were captured in the open near this *Pseudococcus*.

Attempts to import *Aenasius paulistus* n. sp. into California, through the cooperation of Edson Hambleton, are being made for its possible use against *Pseudococcus maritimus* (Ehrh.).

SUPPLEMENTARY NOTE

After completion of the paper on the classification of the species of *Aenasius*, a small collection of mealybug inhabiting parasites was received for identification from Dr. Walter Carter, Experiment Station, Pineapple Producers' Cooperative Association, Ltd., Honolulu, Hawaii. Among them were the following two species of *Aenasius* which were imported into Hawaii from Colombia to be used in the attempt to control *Pseudococcus brevipes* (Ckll.) in the Islands by biological methods.

Aenasius colombiensis n. sp.

The principal diagnostic characters of this form are the same as those of *cariocus* Compere: namely, scape more than two and one-half times as long as wide; scutellum with fine tessellate reticulations and setiferous punctation no coarser than on the mesoscutum; tegulae blackish; femora and tibiae more or less brown; umbilicate punctations in two irregular rows between the inner anterior orbits and facial depression and descending almost to the genal sulci; forewings with a small, hairless hyaline streak distad of the stigmal and postmarginal veins; postmarginal vein not extending as far distad as the stigmal vein; ocelli in a right triangle;

frontovertex at narrowest with four or five rows of irregularly placed, coarse, umbilicate punctations; forewings triangular, not markedly reflexed on the outer anal curvature.

This form differs from *cariocus* in color. In *cariocus* the first five funicle joints are testaceous, the sixth blackish; scape testaceous except the dorsal and ventral margins on the basal two-thirds which are blackish.

Female.—Frontovertex black metallic with violaceous and greenish reflections, the ocellar area less refringent; facial impression and cheeks slightly green. Thorax and abdomen black, metallic. Sides of scape more or less longitudinally streaked with brown towards the apex, remainder of scape, pedicel, club, and more or less of the first four funicle joints blackish.

Legs dominantly black, marked with more or less brownish as follows: all tarsi except the apical joints; distal ends of middle and hind femora faintly suffused; tibiae of middle and hind legs faintly suffused on the sides. Tibial spur blackish.

Male.—Very similar to *hyettus* (Walker). The most apparent differences are that in this form the forewings are embrowned beneath the venation as far distad as the speculum, the marginal vein is less than twice as long as wide and about one-half as long as the postmarginal vein. In the male sex of *hyettus*, the forewings are not embrowned; the marginal vein is about thrice as long as wide and about one-half as long as the postmarginal vein. The antennae are very similar to those of *hyettus*.

Described from 17 females and 15 males, holotype, allotype, and paratypes, reared from a species of *Pseudococcus* collected by E. G. Salas at Barbosa, Colombia, October, 1935.

***Aenasius cariocus* Compere.**

Ten females, reared from *Pseudococcus* sp. are referred to this species. They were collected by E. G. Salas at Bucaramanga, Colombia, September, 1935, and reared by Carter at Honolulu.